

Claims

We claim:

1 1. A polynucleotide encoding a mutant starch biosynthesis protein, or a biologically-
2 active fragment or variant of said mutant protein, wherein said mutant protein exhibits
3 increased heat stability relative to the wild type protein.

1 2. The polynucleotide according to claim 1, wherein said mutant protein encoded by
2 said polynucleotide is a plant AGP protein.

1 3. The polynucleotide according to claim 2, wherein said mutant protein encoded by
2 said polynucleotide comprises an amino acid mutation in the large subunit of said protein.

1 4. The polynucleotide according to claim 2, wherein said mutant protein encoded by
2 said polynucleotide comprises an amino acid mutation in the small subunit of said protein.

1 5. The polynucleotide according to claim 3, wherein said mutant protein encoded by
2 said polynucleotide comprises an amino acid mutation wherein a histidine residue at position
3 333 in the amino acid sequence of said protein is replaced by an amino acid that confers heat
4 stability to said protein.

1 6. The polynucleotide according to claim 5, wherein said amino acid substituted for
2 histidine at position number 333 is a glycine.

1 7. The polynucleotide according to claim 5, wherein said amino acid substituted for
2 histidine at position number 333 is a phenylalanine.

1 8. The polynucleotide according to claim 5, wherein said amino acid substituted for
2 histidine at position number 333 is a methionine.

1 9. The polynucleotide according to claim 1, wherein said mutant protein encoded by
2 said polynucleotide further comprises an amino acid mutation that confers increased seed
3 weight to a plant expressing said polynucleotide.

1 10. The polynucleotide according to claim 9, wherein said polynucleotide comprises
2 the *Rev6* mutation.

1 11. The polynucleotide according to claim 9, wherein said polynucleotide encodes
2 a maize large subunit AGP enzyme wherein at least one serine residue is inserted between
3 amino acids 494 and 495 of the native AGP enzyme subunit.

1 12. The polynucleotide according to claim 9, wherein said polynucleotide encodes
2 a maize large subunit AGP enzyme wherein the amino acid pair tyrosine:serine is inserted
3 between amino acids 494 and 495 of the native AGP enzyme subunit.

1 13. The polynucleotide according to claim 9, wherein said polynucleotide encodes
2 a maize large subunit AGP enzyme wherein the amino acid pair serine:tyrosine is inserted
3 between amino acids 495 and 496 of the native AGP enzyme subunit.

1 14. A method for increasing resistance of a plant to heat stress conditions, said
2 method comprising incorporating the polynucleotide of claim 1 into the genome of said plant
3 and expressing the protein encoded by said polynucleotide molecule.

1 15. The method according to claim 11, wherein said plant is a monocotyledonous
2 plant.

1 16. The method according to claim 15, wherein said monocotyledonous plant is
2 selected from the group consisting of rice, wheat, barley, oats, sorghum, maize, lilies, and
3 millet.

1 17. The method according to claim 14, wherein said plant is *Zea mays*.

1 18. The method according to claim 14, wherein said plant is a dicotyledonous plant.

1 19. The method according to claim 18, wherein said dicotyledonous plant is selected
2 from the group consisting of peas, alfalfa, chickpea, chicory, clover, kale, lentil, prairie grass,
3 soybean, tobacco, potato, sweet potato, radish, cabbage, rape, apple trees, and lettuce.

1 20. A plant or plant tissue comprising the polynucleotide molecule of claim 1.

1 21. The plant or plant tissue according to claim 20, wherein said plant or plant tissue
2 is monocotyledonous.

1 22. The plant or plant tissue according to claim 21, wherein said monocotyledonous
2 plant or plant tissue is selected from the group consisting of rice, wheat, barley, oats,
3 sorghum, maize, lilies, and millet.

1 23. The plant or plant tissue according to claim 20, wherein said plant is *Zea mays*
2 or said plant tissue is from *Zea mays*.

1 24. The plant or plant tissue according to claim 20, wherein said plant or plant tissue
2 is dicotyledonous.

1 25. The plant or plant tissue according to claim 24, wherein said dicotyledonous plant
2 or plant tissue is selected from the group consisting of peas, alfalfa, chickpea, chicory, clover,
3 kale, lentil, prairie grass, soybean, tobacco, potato, sweet potato, radish, cabbage, rape, apple
4 trees, and lettuce.

1 26. The plant tissue according to claim 20, wherein said plant tissue is a seed.

1 27. A mutant starch biosynthesis protein encoded by the polynucleotide of claim 1.

1 28. A method for identifying a polynucleotide encoding a mutant starch biosynthesis
2 protein wherein said mutant starch biosynthesis protein exhibits increased heat stability
3 relative to a wild type protein, said method comprising mutating a polynucleotide encoding
4 a starch biosynthesis protein, expressing said mutated polynucleotide in a cell to produce a
5 mutant starch biosynthesis protein, and determining whether said mutant starch biosynthesis
6 protein exhibits increased heat stability relative to the wild type starch biosynthesis protein.

1 29. A method for increasing a characteristic of a plant selected from the group
2 consisting of seed number, plant biomass, Harvest Index, flag leaf weight, seed heads, and
3 total seed weight, said method comprising incorporating the polynucleotide of claim 10 into
4 the genome of said plant and expressing the protein encoded by said polynucleotide molecule.